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THE LAST way of *Separation* is by *Quick-silver*. And this is for filings of small Workers and Goldsmiths, wherein Gold and Silver are mixed with dust, &c. This dust is put into a Hand-mill with Quick-silver, and being continually turned upon that, and the Metals, an Amalgama is made of them, and fair water poured in, carries off the dust as it runs out again by a small Quill.

This Amalgama is put into an Iron with a Bolt Head, set into the fire, having a long Iron-neck three feet long, to which is fitted a Receiver. The fire distils off the *Mercury* into the Receiver, and the Gold and Silver remain in the Bolt Head.

An Account of the English Alum-Works, communicated by Daniel Colwall Esquire.

A *Lum* is made of a Stone digged out of a Mine, of a Sea-weed, and Urine.

The Mine of Stone is found in most of the Hills between *Scarborough* and the River of *Tees* in the County of *York*. As also near *Preston* in *Lancashire*. It is of a blewish colour, and will clear like *Cornish-slate*.

That Mine which lies deep in the Earth, and is indifferently well moistned with Springs, is the best. The dry Mine is not good. And too much moisture, cankers and corrupts the Stone; making it Nitrous.

In this Mine are found several Veines of Stone called Doggers; of the same colour, but not so good.

Here are also found those which are commonly called Snake-stones. The people have a Tradition, that the Country thereabouts being very much annoyed with Snakes, by the Prayers of St. *Hilda* there inhabiting, they were all turned into Stones, and that no Snake hath ever since been seen in those parts.

For the more convenient working of the Mine, which some times lies twenty yards under a surface or Cap of Earth, (which must be taken off and barrowed away) they begin their work on the declining of a Hill, where they may also be well furnished with Water. They digg down the Mine by stages, to save Carriage; and so throw it down near the places where they Calcine it.

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The Mine, before it is Calcin'd being expos'd to the Air, will moulder in pieces, and yield a Liquor whereof *Copperas* may be made: but being Calcin'd, is fit for *Alum*. As long as it continues in the Earth, or in Water, it remains a hard Stone.

Sometimes a Liquor will issue out of the side of the Mine, which by the heat of the Sun is turned into Natural *Alum*.

The Mine is calcined with Cinders of *New-Castle* Coal, Wood and Furzes. The Fire made about two feet and a half thick, two yards broad, and ten yards long. Betwixt every Fire, are stops made with wet Rubbish; so that any one or more of them may be kindled, without prejudice to the rest.

After there are 8. or 10. yards thickness of broken Mine laid on this Fewel, and five or six of them so covered: Then they begin to kindle the Fires: and as the Fires rise towards the top, they still lay on fresh Mine. So that, to what height you can raise the Heap, which is oftentimes about twenty yards, the Fires, without any further help of Fewel, will burn to the top, stronger than at the first kindling, so long as any Sulphur remains in the Stones.

In Calcining these Stones, the Wind many times doth hurt, by forcing the Fire in some places too quickly through the Mine, leaving it black and half burnt; and in others burning the Mine too much, leaving it Red. But where the Fire passeth softly and of its own accord, it leaves the Mine white, which yields the best and greatest quantity of Liquour.

The Mine thus Calcin'd is put into Pits of Water, supported with Frames of Wood, and rammed on all sides with Clay; about ten yards long, five yards broad, and five feet deep; set with a Current that turneth the Liquor into a Receptory, from whence it is pumped into another Pit of Mine. So that every Pit of Liquor, before it comes to boyling, is pumped into four several Pits of Mine; and every Pit of Mine is steeped in four several Liquours, before it be thrown away; the last Pit being always fresh Mine.

This Mine thus steeped in each of the several Liquors twenty four hours or there about, is of course, four days in passing the four several Pits, from whence the Liquors pass to the Boyling-House.

The Water, or Virgin-Liquor oft times gains, in the first
6 Y 2 Pit,

Pit, two pound weight. In the second encreaseth to five pound weight. In the third, to eight pound weight. And in the last Pit, which is always fresh Mine, to twelve pound weight; and so in this proportion, according to the goodness of the Mine, and the well Calcining thereof. For sometimes the Liquors passing the four several Pits, will not be above six or seven pound weight. At other times, above twelve pound weight, seldome holding a constant weight, one week together. Yet many times Liquor of seven or eight pound weight produceth more, *Alum*, than that of ten or twelve pound weight either through the illness of the Mine, or, as usually, the bad Calcining thereof. And if by passing the weak Liquor through another Pit of fresh Mine, you bring it to ten or twelve pound weight, yet you shall make less *Alum* with it, than when it was but eight pound weight. For what it gains from the last Pit of Mine, will be most of it Nitre, and *Slam*, which poysons the good Liquors, and disorder the whole House, until the *Slam* be wrought out.

That which they call *Slam*, is first perceived by the redness of the Liquor when it comes from the Pit, occasioned either by the illness of the Mine, or as commonly the over or under Calcining of it; as above said; which in the Setler sinks to the bottom, and there becomes of a muddy substance, and of a dark colour. That Liquor, which comes whitest from the Pits, is the best.

When a Work is first begun, they make *Alum* of the Liquor only that comes from the Pits of Mine, without any other Ingredients. And so might continue, but that it would spend so much Liquor, as not to quit cost.

Kelp is made of a Sea-weed, called Tangle, such as comes to *London* on Oysters. It grows on Rocks by the Sea side, between High-water and Low-water mark. Being dried, it will burn and run like Pitch; when cold and hard, 'tis beaten to ashes, steeped in Water, and the Lees drawn off to two pound weight, or thereabout.

Because the Country people, who furnish the Work with Urine, do sometimes mingle it with Sea-Water, which cannot be discovered by weight: they try it, by putting it to some of the boyling Liquor. For so, if the Urine be good, it will work, like Yest put to Beer or Ale, but if mingled it will stir no more than so much Water.

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It is observed, that the best Urine is that which comes from poor labouring People, who drink little strong Drink.

The Boyling Pans are made of Lead, nine feet long, five feet broad, and two and a half deep: set upon Iron Plates about two inches thick, which Pans are commonly new cast, and the Plates repaired five times in two years.

When the Work is begun, and *Alum* once made, then they save the Liquor which comes from the *Alum*, or wherein the *Alum* shoots, which they call Mothers. With this they fill two third parts of the Boylers, and put in one third part of fresh Liquor vvhich comes from the Pits. Being thus filled up vvith cold Liquor, the Fires having never been dravvn out, vvill boil again in less than two hours time. And in every two hours time, the Liquor will waste four Inches, and the Boylers are filled up again with green Liquor.

The Liquor if good, will in Boyling, be greasy, as it were, at the top: if Nitrous, it will be thick, muddy, and red. In boyling twenty four hours, it will be thirty six pound weight. Then is put into the Boyler about a Hogs-head of the Lees of Kelp, of about two peny weight, which will reduce the whole Boyler to about twenty seven pound weight.

If the Liquor is good, as soon as the Lees of Kelp are put into the Boyler, they will work like Yest put to Beer. But if the Liquor in the Boyler be Nitrous, the Kelp-Lees will stir it but very little; and in that case, the Workmen must put in the more and stronger Lees.

Presently after the Kelp Lees are put into the Boyler all the Liquor together is drawn into a Setler, as big as the Boyler, made of Lead, in which it stands about two hours; in which time, most of the Nitre and Slam sink to the bottom.

This separation is made by means of the Kelp-Lees. For when the whole Boyler consists of Green-Liquor drawn from the Pits it is of power strong enough to cast off the Slam and Nitre: but when Mothers are used, the Kelp-Lees are needfull to make the said separation.

Then the said Liquor is scooped out of the Setler, into a Cooler, made of Deal-boards, and rammed with Clay. Into this is put 20. Gallons or more of Urine, more or less, according to the goodness or badness of the Liquor. For if the Liquor be red, and consequently Nitrous, the more Urine is required.

In the Cooler, the Liquor in temperate weather, stands four days. The second day the *Alum* begins to strike, gather and harden about the sides, and at the bottom of the Cooler.

If the Liquor should stand in the Cooler above four days, it would as they say turn to *Copperas*.

The use of Urine, is as well to cast off the Slam, as to keep the Kelp-Lees from hardning the *Alum* too much.

In hot weather, the Liquors will be one day longer in cooling, and the *Alum* in gathering, than when the weather is temperate. In frosty weather the cold strikes the *Alum* too soon, not giving time for the Nitre and Slam to sink to the bottom, whereby they are mingled with the *Alum*. This produceth double the quantity: But being foul, is consumed in the washing.

When the Liquor hath stood four days in the Cooler: Then that called Mothers is scooped into a Cistern, the *Alum* remaining on the sides and at the bottom; and from thence the Mothers are pumped back into the Boyler again. So that every five days, the Liquor is boyled again, untill it evaporate or turn into Alum or Slam.

The *Alum* taken from the sides and bottom of the Cooler, is put into a Cistern, and washed with Water that hath been used for the same purpose, being about twelve pound weight. After which it is Roached, as followeth.

Being washed, it is put into another Pan with a quantity of Water, where it melts and boils a little. Then is it scooped into a great Cask, where it commonly stands ten days, and is then fit to take down for the Market.

The Liquors are weighed by the Troy-weight. So that half a pint of Liquor must weigh more than so much Water, by so many penny weight.

*An Account of the way of making English Green-Copperas,
Communicated by the same.*

C*opperas* stones, which some call Gold-stones, are found on the Sea-shore in *Essex*, *Hampshire*, and so Westward. There are great quantities on the Cliffs; but not so good, as those on the Shore, where the Tides Ebb and Flow over them.

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